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BOOK REVIEW

Stopping Powers and Ranges for Protons and Alpha Particles (ICRU Report 49)

International Commission on Radiation Units and Measurements

Bethesda, Maryland 20814, U.S.A., 1993
x+286 pages, tables illustrations , softcover ISBN 0-913394-47 5

This book contains stopping power and range tables for protons and alpha particles in various materials Such information is of interest in radiological physics and biomedical dosimetry. The tabulated reslts include (i) electronic, nuclear and total stopping powers, (ii) CSDA ranges based on continuous slowing down approximation, (iii) detour factors which relate the range to the average depth of penetration. This book has fairly described the methodology of stopping power measurements. The tabulated collision stopping powers at low energies shown are based on experimental data. At high energies, those are based on Bethe's stopping power theory with semiempirical mean excitation energies and shell corrections and with corrections for departures from the first Born approximation.

This report contains nine chapters and are the following :

Chapter I deals with the definition of stopping power and related quantities. The methodology adopted for the evaluation of stopping powers has been shown. The utility and limitations of stopping powers are discussed.

Chapter II describes the evaluation of stopping powers from Bethe's theory Various corrections like Bloch correction, Barkas correction, shell corrections, density effect corrections, were described in details.

Chapter III includes the electronic stopping powers in the low energy region. The comparison of theoretical and experimental stopping power is fairly demonstrated.

Chapter IV described the nuclear stopping power in H, C, Al and Au This report accounts the contribution from nuclear stopping power in the measured total stopping power. The reduction of nuclear stopping powers as a function of cut-off angle θ_t is also demonstrated for protons and alpha particles in C and Au materials. The detailed comparison of calculated and experimental stopping powers for protons and alpha particles is presented in Chapter V.

An information on energy loss straggling has been given in Chapter VI along with a brief historical background.

CSDA ranges for protons and alpha particles in water, range straggling of protons after Sternheimer and detour factors for protons and alpha particles are presented in Chapter VII.

Chapter VIII represents the stopping power and range tables for protons and alpha particles in different materials.

The description of various methods for stopping power measurements which are of great importance for nuclear physics data analysis, is impressive. The utilisation of natural radioactive sources like ^{241}Am, ^{238}Pu, ^{242}Cm, ^{148}Gd, ^{252}Cf have been discussed. An attention has been paid by the authors on the interpretation of foil or gas in primary or scattered beams from accelerated ions. The shift in energy of elastically scattered particles has been explained. Thermometric compensation techniques at liquid helium temperature and inverted Doppler-Shift-Attenuation method have been discussed in detail. This book has given an evidence in support of time of flight method for energy-loss determination with Si detectors.

The high energy stopping power measurements of protons and alpha particles from linear accelerators and also from heavy ions from Vande Graff's have been taken into account.

A detailed survey has been made by the authors on various methods on stopping power measurements, like X-ray emission yields, gamma ray yield or neutron yield from thin or thick targets *etc*.

The tables show the stopping powers, CSDA ranges, detour factors at different energies in H, Be, C, N, O, Ne, Al, Si, Ar, Ti, Fe, Cu, Ge, Kr, Mo, Ag, Sn, Xe, Ga, Tu, Pt, Au, Pb, U, Air, tissue *etc*. It is an exhaustive compilation of Range-Energy relations in various materials.

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